September, when the southwest monsoon was not so active. In fact, it should be noted that the southwest monsoon current over the Philippine Islands, China Sea, and regions west and southwest, was quiet throughout the month of September, hardly ever reaching velocities of 50 k. p. h. and then only when a typhoon was exerting its influence. Bandon, Thailand, was reporting ascents almost every day until September 10, with velocities approximately 50 k. p. h., but the latter part of the month showed the southwesterly current much weaker. Regarding Guam, the velocities were almost always below 50 k. p. h., the exceptions being: (1) September 5 and 6, when the typhoon of September 2–12 was located north of Guam (southwest, west-southwest, west directions; 38–70 k. p. h. velocities); (2) September 15, when the typhoon of September 11–19 was central northwest of Guam (south to south-southwest directions; 44–67 k. p. h. velocities); and (3) September 24 and 25, when the typhoon of September 22–October 2 was west-northwest and northwest of Guam (southeast, south-southeast, and south directions; 29–67 k. p. h. velocities). U. S. Navy vessels at Tsingtao and Shanghai, China, frequently reported ascents that showed north, northeast, and east quadrant winds, with velocities between 20 and 60 k. p. h., sometimes due to typhoons, often not. This concludes the brief summary of September upper winds over the Far East.

RIVER STAGES AND FLOODS

By BENNETT SWENSON

Precipitation during September 1940 was deficient and river stages were generally low over the country east of the Rocky Mountains, except in New England and in portions of New Jersey, Oklahoma, and Kansas. In the area from the Rocky Mountains and Montana westward, except in California, the rainfall was decidedly above normal. Floods during the month were confined principally to small streams in New Jersey and the Arkansas River and tributaries in northeastern Oklahoma.

Atlantic Slope Drainage.—Heavy rains occurred on September 1 in southwestern New Jersey during the northward passage of a tropical disturbance with its center about 150 miles off the New Jersey coast. The greatest 24-hour amounts (within 12 hours at most stations) reported were: Clayton, 10.52; Pemberton, 6.70; Woodbury, 6.50; Woodstown, 5.40; North Merchantville, 5.19; Burlington, 4.86; Moorestown, 4.50, and Trenton No. 2, 4.91 inches. Severe flooding occurred in a number of the smaller rivers, and several dams broke, resulting in the loss of four lives and property damage (mostly to highways and bridges) estimated at more than $1,000,000.

Stages were slightly above flood stage at some points in the James, Santee, and Savannah Rivers early in September, being largely a continuation of the August flood conditions.

Arkansas Basin.—Unusually heavy rainfall occurred on September 3–4 over a small area in northeastern Oklahoma in the vicinity of the junction of the Cimarron and Arkansas Rivers. Rainfall amounts of 8 inches or more were recorded in a narrow band approximately 30 miles wide and 100 miles long, paralleling and lying just to the south and west of the Arkansas River from immediately south of Tulsa, Oklahoma, northwestward almost to the Kansas border. The area of greatest precipitation, 18 inches or more, was located in the triangle formed by the junction of the Cimarron and the Arkansas Rivers. The greatest single amount recorded in this area was 19.75 inches at Hallett, Okla.

The observed precipitation for the storm is given in table 1. These data were obtained through the cooperative hydrologic program conducted by the Weather Bureau in cooperation with the Departments of War and Agriculture.

Hourly rainfall amounts obtained from the Weather Bureau airport station recording-gage at Tulsa Airport are given in table 2. Additional precipitation reports by Weather Bureau observers in Oklahoma and in southeastern Kansas may be found in Climatological Data for September, issued by the section centers of the respective States.

The meteorological conditions which gave rise to the unusual precipitation are not clearly discernable on the surface weather map. However, the isentropic chart, from upper-air soundings, gives an explanation of the causes.

On the morning of September 3 a large, cold cyclonic eddy appeared on the 314° potential-temperature surface with center over Oregon. In advance of this eddy a moist tongue of air was advancing northward over extreme eastern Mexico, extending northward to extreme eastern Montana. The flow pattern gives some indication of a separate anticyclonic eddy branching eastward over Kansas.

On the same potential-temperature surface for the morning of September 4 the southern anticyclonic branch was well established, indicating a moist tongue curving sharply anticyclonically and moving up-slope toward the southeast over southeastern Kansas and northeastern Oklahoma. The stream functions showed this southern eddy to be centered over Texas. Another anticyclonic eddy composed mostly of dry air was central over southern Minnesota. Convergence between these two eddies and the upslope component in the moist eddy brought about the realization of the latent energy in the southern moist tongue. According to the flow pattern, Oklahoma City was not in the center of the moist tongue on either day, but, nevertheless, on both days the Oklahoma City upper-air soundings showed a lapse rate which indicated marked conditional instability. The Oklahoma soundings further indicated that the quantities of available precipitable water were quite high.

The flooding was severe along the Arkansas and Cimarron Rivers in the vicinity of Tulsa, Bristow, and Cleveland. The soil was dry and the stages in the streams were quite low at the beginning of the storm. These conditions tended to reduce runoff and alleviate flood conditions somewhat.

The Arkansas River at Tulsa rose from a stage of 1.8 feet at 8 a. m., to 16.0 feet at 7 p. m., of the 4th. The crest stage reached at that place was 19.3 feet on the morning of the 5th, 3.3 feet above flood stage and just 0.5 foot below the highest stage of record in June 1923. The losses in and around Tulsa have been estimated at more than a million dollars. At Fort Smith, Ark., the river rose to a stage of 19.8 feet on September 7, but no damage was reported.

TABLE 1.—*Observed precipitation and other notes, storm of September 3–4, 1940*

[DN denotes during night. DNA denotes during night after midnight]

Station	Date: September 1940	Began	Ended	Observed at	Amount, inches	Remarks
Creek County:						
Bowden (near)	3	DN		End of storm	16.25	Streeter-Speakman farm, located 1 mile south and 6¼ miles west of Bowden measured 16.25 inches in an oil barrel, straight sides. Oil barrel was empty at start of rain. Record reliable. U. S. E. D.
	4		p. m.			
Do	3	DN		do	13+	Harry Vandecar farm 1 mile south and 5¼ miles west of Bowden. 5-gallon can 13 inches high ran over. Exact time can ran over not known. U. S. E. D.
	4		p. m.			
Bristow	2			7:00 p	0	Weather Bureau observer. 8-inch standard nonrecorder. Heaviest rain fell from 10 a. m. to 3 p. m. on Wednesday. All highway traffic on US 66 eastbound held up in Bristow until Saturday.
	3	DNA	DNA	8:00 a	.49	
		11:20 a.	6:43 p.	7:00 p	.58	
	4	DNA	DNA	8:00 a	.55	
		8:52 a.	7:00 p.	7:00 p	4.29	
	5				0	
Bristow (near)	3	DN		After storm	9.50	Noel Dicks, central commercial lease, 9 miles north-northeast of Bristow, measured 9½ inches rainfall for the storm. Measurement made in a 11-inch-deep, straight-sided bucket. U. S. E. D.
	4		p. m.			
Do	3	DN		End of storm	6.90	E. R. Burrus, service station, had milk pail out in open which measured 0.725 foot deep, 10.8 inches across top, 8.4 inches across bottom. Amount of rainfall computed to be 6.9 inches. U. S. E. D.
	4		p. m.			
Drumright (near)	3			do	11.50	W. R. Whitehead, 1 mile west of Drumright substation or 6½ miles east of Drumright on Highway 67, measured 13½ inches in water keg which contained about 2½ inches in keg at start of rain; and straight-sided cooker, 9½ inches deep, ran over at 10 a. m. on Wednesday, probably not more than 2 or 3 inches fell after cooker overflowed. U. S. E. D.
	4					
Do	3	DN		do	3.00	Mr. Patton, located on farm 3 miles southwest of Drumright across from Oak Grove School, measured 3.0 inches in a well-exposed straight-sided can. Measurement good. Mr. Patton measures all rainfall but does not keep permanent record.
	4		P. m.			
Do	4	(1)			8.50	J. A. Gregory, located 9½ miles east of Drumright reported that 8.5 inches of rainfall was measured from 8 a. m. to noon on Wednesday. U. S. E. D.
Do	3			do	7.80	D. M. Ladd, located 6 miles east of Drumright and ½ mile south on Highway 67. 7.8 inches rainfall measured in tub. U. S. E. D.
	4					
Drumright	3			do	5.00	5.0 inches measured in water bucket at residence of Wayne Deeds in Drumright. U. S. E. D.
	4					
Drumright (near)	3			During storm	9.6+	J. B. Steele, 14 miles east of Drumright reported that No. 3 washtub ran over. Depth of rainfall equivalent for one No. 3 tub-full is 9.6 inches. U. S. E. D.
	4					
Do	3			1:00 p	9.6+	H. E. Glimp, 8 miles east of Drumright reported that No. 3 washtub ran over at 1 p. m. on Sept. 4, 1940. U. S. E. D.
	4					
Do	3	DN		(?)	8.7+	J. B. Johnson, 11 miles east of Drumright caught a No. 2 washtub full; tub ran over. Rainfall equivalent for No. 2 tub is 8.7 inches. U. S. E. D.
	4		P. m.			
Do	3	DN		(?)	5.2+	W. S. Summer, 10 miles east of Drumright had 10-quart pail 0.725 foot deep, 0.85 foot top diameter, 0.675 foot bottom diameter caught full. Rainfall equivalent of bucket full is 5.2 inches.
	4		P. m.			
Kellyville	3	Nite		End of storm	13.50	Tom Hawkins, Kellyville, Okla. Mr. Hawkins caught 13½ inches in a ½ of a 55-gallon oil drum. This is a reliable measurement. U. S. E. D.
	4		P. m.			
Kellyville (near)	3	DN		(?)	10+	Devonian Oil Co., located 2 miles southwest of Kellyville on U. S. Highway 66, report that gallon paint can 10 inches high with straight side ran over before rain stopped. Probably rained 3 inches more after can was full. Good exposure. Small creek just south of plant flooded, water reaching into pumping-plant equipment.
	4		Early p. m.			
Do	3			End of storm	12.00	Roy Ralston, 5 miles SW. of Kellyville measured 12 inches in a square tub. U. S. E. D.
	4					
Do	3			do	12.00	John H. Watkins farm, 0.8 mile west and 1 mile north of Kellyville. 12 inches measured in lard bucket during storm. This is a fair record. U. S. E. D.
	4					
Do	3			do	13.50	E. E. Greer, located 4 miles west of Kellyville on U. S. Highway 66, measured 13.5 inches of rainfall after storm. A good record. U. S. E. D.
	4					
Do	3			(?)	9.6+	Noah Sewell, 3½ miles east of Kellyville said that a No. 3 tub was filled and ran over; he estimated that an additional 5½ inches of rain fell after tub was filled. Rainfall equivalent for a full No. 3 tub is 9.6 inches. Estimated total for storm 15 inches. U. S. E. D.
	4					
Do	3			(?)	12.6+	B. F. Seifert, 5 miles southeast of Kellyville. Mr. Seifert stated that a bucket 12.6 inches deep ran over and that very little rain fell after bucket was filled. U. S. E. D.
	4					
Do	3			(?)	12.5+	Fred Cornelius, 4 miles south and 1 mile west of Kellyville measured a 12½-inch deep bucket. States that bucket ran over a little.
	4					
Keystone (near)	3			End of storm	13.80	Tom Starform, 3 miles south of Keystone on Coyote Trail measured 1.15 feet of rainfall in a 10-gallon straight-sided can. This measurement should be considered very good. U. S. E. D.
	4					
Mannford	3			do	16.00	George Moore, Mannford, Oklahoma, measured 16 inches in ½ of a 55-gallon oil drum. This measurement rated good.
	4					
Mannford (near)	3			(?)	13+	W. S. Taylor, on farm 1 mile north of Mannford, measured 13 inches before storm ended on September 4, 1940. He estimates that at least 2 inches more fell after his measurement. U. S. E. D.
	4					
Do	3			6:30 a	9.40	Jim Hinton, 5 miles southwest of Mannford on State Highway No. 33, caught a No. 2 tub full (rainfall equivalent of 9.4 inches) before 6:30 a. m. on Wednesday, Sept. 4, 1940. Cottonwood creek 2 feet above bridge at this point—not much crop damage, however. U. S. E. D.
	4					
Mounds	3			End of storm	14.00	C. G. Weller, Phillips Petroleum Station, Mounds, Okla., measured 14 inches. This is a good measurement.
	4					
Mounds (near)	3	DN		Noon	12.00	Mr. Tom Bacon, on small farm 1 mile south of Mounds P. O., has been measuring rainfall for a number of years. He has a straight-sided can mounted on a post 5 feet above the ground and well exposed. Mr. Tom Bacon reported 12 inches of rain for the 24-hour period ending at noon on Sept. 4, 1940. This is a very reliable record.
	4		Noon			
Oilton	3			(?)	9.6+	Mr. C. L. Diehmel, Oilton, Okla., reported that a No. 3 tub (rainfall equivalent of 9.6 inches) ran over early Wednesday morning. U. S. E. D.
	4					
Oilton (near)	3			End of storm	17.00	C. D. Wortham, located 5½ miles east of Oilton on Highway No. 33, measured 17 inches in ½ of a 55-gallon oil drum. U. S. E. D.
	4					
Do	3			8:00 a	9.6+	Frank Johnson, 6 miles east of Oilton on Highway No. 33, reported that a No. 3 tub (rainfall equivalent of 9.6 inches) ran over at 8 a. m. on Wednesday morning. U. S. E. D.
	4					

[1] Measured rainfall from 8 a. m. to noon.

TABLE 1.—*Observed precipitation and other notes, storm of September 3–4, 1940*—Continued

Station	Date: September 1940	Began	Ended	Observed at	Amount, inches	Remarks
Creek County—Continued.						
Red Fork (near)	3			11:00 a	9.6+	H. Stanis, located 7 miles south and ½ mile east of Red Fork, reports that a No. 3 tub ran over about 11 a. m. on Wednesday. U. S. E. D.
	4					
Rock Creek (near)	3	DN		(?)	13+	Fred Graham, located 7 miles south of Rock Creek P. O., reported that a 5 gallon can 13 inches high with straight sides ran over, may have lost about 1 inch. U. S. E. D.
	4		3:30 p.			
Sapulpa	2	DN	DN	7:30 a		Weather Bureau observer. 8 inch standard nonrecorder. Gage at city waterworks. Rain began on Tuesday night and ended Wednesday at 3 p. m. Rock Creek flooded. Pumping plant, located on high bank next to Rock Creek, flooded; water about waist deep all around plant. Water level reached top of box support of rain gage, however, gage functioned. Part of U. S. Highway 66 just north of pumping plant washed out.
	3	DN		7:30 a	.80	
	4		3:00 p.	7:30 a	7.80	
	5			7:30 a	7.70	
Sapulpa (near)	3	Mid't.		3:00 p	14.00	J. B. Henderson Salvage Co., ¾ mile west of Sapulpa, caught 14 inches in an iron kettle (14 inches is computed amount of catch in iron kettle). U. S. E. D.
	4		3:00 p.			
Do	3	DN		11:00 a	8.7+	A. L. Steeples, located 3 miles east and 2 miles north of Sapulpa, caught a No. 2 tub full at 11 a. m. Wednesday morning. Rainfall equivalent of a No. 2 tub is 8.7 inches. Probably rained 3 inches more after 11 a. m. on Sept. 4. U. S. E. D.
	4		P. m.			
Kay County:						
Chilocco	2			Late p. m	0	Observations made by Chilocco Indian School. Weather Bureau standard nonrecorder. Observer reports that steady rain fell from 6 a. m. to 10:30 a. m. on Sept. 4.
	3	Mid't.		do	.49	
	4		1:00 p.	do	6.32	
Dilworth (near)	3	DNA		After storm	6.00	Mr. Giblen, located 1 mile north of Dilworth on farm, Sec. 32, T. 29 N., R. 1 E., reported 6 inches rainfall, measured in a straight-sided can. Reliable measurement. Heaviest rain fell around 5 a. m. on Sept. 4.
	4		11:00 a.			
Do	3	DNA		do		Reported by Soil Conservation Service Flood Control Survey, Blackwell, Okla., 1½ miles SW. of Dilworth. Measured in a straight-sided can.
	4		Noon		3.50	
Kildare (near)	2	Noon	4:00 p.	7:00 a	0	Mr. Owens, located at Ponca City Lake, 2 miles east of Kildare, Okla., 8-inch standard U. S. W. B. tube type nonrecorder. Gage is operated by Ponca City water department, Ponca City, Okla.
	3	DNA		7:00 a	2.24	
	4		4:00 p.	7:00 a	8.14	
	5			7:00 a	.28	
Do	3	DNA		After storm	5.00	Guy Ray, located on farm 6 miles west and 1½ miles north of Kildare, Okla., Sec. 14, T. 27 N., R. 1 E., measured 5 inches in a straight sided bushel measure.
	4		P. m.			
Newkirk	3	DNA		7:00 a	.90	Weather Bureau observer. Eight-inch standard nonrecorder.
	4		Noon	7:00 a	3.76	
	5			7:00 a	2.55	
Peckham (near)	3	DNA		End of storm	6.00	Reported by Soil Conservation Flood Control Survey, Blackwell, Okla., 1 mile south of Peckham. Measured in straight-sided bushel measure. Heaviest rain from 6 to 9 a. m. on Sept. 4.
	4		Noon			
Ponca City	2	12:30 p.	4:00 p.	6:00 p	.53	Weather Bureay airway station at Ponca City Airport. 8-inch standard nonrecorder.
	3	1:30 p.	3:40 p.	6:00 p	.80	
	4	2:10 a.	1:45 p.	6:00 p	2.61	
	5			6:00 p	0	
Okmulgee County:						
Bald Hill (near) (SCS No. 2).	3	4:00 p.		8:00 a	0	C. C. C. Camp, SCS-14-OK, Morris, Okla. Gage located 2½ miles SW. of Bald Hill in Section 7, Twp. 14 N., R. 14 E. 8-inch standard nonrecorder.
	4		P. m.	8:00 a	2.67	
	5			8:00 a	1.07	
Beggs	3			End of storm	10.00	Postmaster at Beggs reported that several farmers and men in town measured around 10 inches in straight-sided cans. Reliable information.
	4					
Do	3			do	10.50	Water department of Beggs, estimated and partly measured 10.5 inches. U. S. E. D.
	4					
Beggs (near)	3			do	12.50	S. J. Baker, located on farm 4 miles north of Beggs, measured 12.5 inches in an oil drum. U. S. E. D.
	4					
Do	3			do	10.50	Mr. Naylor, 3¼ miles west of Beggs, measured 10.5 inches. This is an extra good measurement. Reliable. U. S. E. D.
	4					
Morris (SCS No. 1)	3	4:00 p.		8:00 a	0	C. C. C. Camp, SCS-14-Ok, Morris, Okla. Gage located within city limits of Morris. 8-inch standard nonrecorder. No damage. Lowlands to SW. flooded slightly, especially where small Goose Creek runs into Deep Fork River.
	4		P. m.	8:00 a	1.70	
	5			8:00 a	1.80	
Natura	3			End of storm	9.50	Mr. Hacker, school teacher at Natura, measured 9.5 inches. U. S. E. D.
	4					
Natura (near)	3			do	10.00	George Pickering, 2 miles north of Natura, measured 10 inches during storm. U. S. E. D.
	4					
Do	3			do	6.50	Two road workers, 3 miles south of Natura, reported they measured 6.5 inches of rain in a No. 8 lard bucket.
	4					
Do	3			do	11.50	Mr. Harton, 1 mile north of Natura, measured 2 inches from top of a 5 gallon oil bucket, or 11.5 inches. U. S. E. D.
	4					
Do	3			do	10.50	Sal Burch, 3 miles north and 1 mile east of Natura, measured 10.5 inches. U. S. E. D.
	4					
Okmulgee	3	3:00 a.		7:00 a	3.55	Weather Bureau observer. 8 inches standard nonrecorder. Gage located 1½ miles west of town on State Highway No. 27. Gage is at city waterworks plant. Deep Fork River runs beside plant and was bank-full, very little overflow into fields and low areas. Okmulgee was cut off from Tulsa to the north.
	4		About 7:00 a	7:00 a	2.46	
	5			7:00 a	.06	
Slick (near)	3			End of storm	7.00	Jennings Service Station, 4 miles east of Slick, measured 7 inches in a No. 2 coffee can. U. S. E. D.
	4					
Osage County:						
Herd	3			7:30 a	0	Weather Bureau observer. 8-inch standard nonrecorder.
	4			7:30 a	.54	
	5			7:30 a	.93	
Hominy	2	(?)		6:30 p	.02	Do.
	3	10:00 a.[2]		6:30 p	.31	
	4		5:00 p.	6:30 p	3.87	
		6:30 p.	7:30 p.			
	5			6:30 p	.01	
Hominy (near)	3	DN		End of storm	6.00	C. R. Manor, on farm 12 miles east and 1 mile south of Hominy on Skiatook highway, measured 6 inches in straight-sided can.
	4		P. m.			
Pawhuska	2	3:30 p.		6:00 p	1.44	Weather Bureau observer. 8-inch standard nonrecorder.
	3			6:00 p	.66	
	4		Late p. m.	6:00 p	2.64	

[2] Thundershower.

[3] Mist.

TABLE 1.—*Observed precipitation and other notes, storm of September 3–4, 1940*—Continued

Station	Date: September 1940	Began	Ended	Observed at	Amount, inches	Remarks
Osage County—Continued.						
Shidler (near)	3	P. m.		End of storm	4.00	Texaco Oil Co. plant, 4 miles south of Shidler, reported 4 inches caught in gallon can. Not much run-off in this area; no heavy rain. Light rains on Tuesday night and Wednesday.
	4		Late p. m.			
Skiatook (near)	3	P. m.		do	5.50	Mrs. P. V. Daniel, 3½ miles west of Skiatook on State Highway No. 20, measured 5.5 inches in a straight-sided, well exposed can. Record very good.
	4		Late p. m.			
Wynona	3	DN		do	5.00	5 inches reported from several fairly reliable sources in city of Wynona.
	4		Late p. m.			
Pawnee County:						
Cleveland	3	DNA		6:00 p	.35	Weather Bureau observer. 8-inch standard nonrecorder. Great deal of run-off in this area, especially a few miles west of Cleveland. Cleveland dam failed, due to flood waters; part of highway bridge below dam on U. S. Highway No. 64 washed out.
	4		4:00 p.	6:00 p	6.57	
Cleveland (near)	3			End of storm	18.50	John Bycek, located 8 miles west of Cleveland on U. S. Highway No. 64, measured 18.50 inches. U. S. E. D.
	4					
Do	3			10:00 a	8.7+	M. H. Moore, 6 miles east and 1¾ miles south of Cleveland, caught a No. 2 tub full at 10:30 a. m. on the 4th; rainfall equivalent of No. 2 tub is 8.7 inches. U. S. E. D.
	4					
Do	3			End of storm	9.00	J. M. Richards, at Johnson Refinery ¾ mile west of Cleveland, measured 9 inches in a straight-sided container. U. S. E. D.
	4					
Do	3			(?)	8.7+	Deems Station, 1½ miles west of Cleveland, measured at No. 2 tub full rainfall equivalent of 8.7 inches.
	4					
Hallett	3			End of storm	19.75	Clark Moore at Hallett, 2 blocks west of paved highway, measured 19.75 inches after storm ended. U. S. E. D.
	4					
Keystone	3			5 days after storm	8.00	W. H. Kurtz, DX Service Station at Keystone, measured 8 inches in a straight sided barrel. Measurement made 5 days after rain ended U. S. E. D.
	4					
Keystone (near)	3			End of storm	11.00	George Millstom, 3 miles west of Keystone on bank of Cimarron River measured rainfall in straight-sided can. Good. U. S. E. D.
	4					
Do	3			do	11.00	George S. Thomas, on Farm 2 miles west of Keystone, measured 11 inches in ½ of a 55-gallon drum. Good. U. S. E. D.
	4					
Do	3			do	9.75	J. N. Woodfin, 3½ miles northwest of Keystone of U. S. Highway No. 64. measured 9.75 inches in a bucket. Good. U. S. E. D.
	4					
Maramec (near)	3			do	19.00	Mr. Wisely, ½ mile south of west side of Maramec, measured 19 inches in a straight-sided container. Mr. Wisely has been in Civil Service and seems very reliable. U. S. E. D.
	4					
Do	3			10:30 a	18.75+	W. C. Carpenter, 2 miles south of Maramec, measured 18.75 inches in a straight-sided cream can, which ran over at 10:30 a. m. on the 4th. U. S. E. D.
	4					
Do	3			End of storm	14.00	C. D. Ryan, 2 miles east and 2 miles north of Maramec, estimated 14 inches, measured in an oil drum, which was protected slightly by house. U. S. E. D.
	4					
Pawnee	3			do	6.50	F. A. Hrabe, hardware store at Pawnee, measured 6½ inches in rain gage. Good record. U. S. E. D.
	4					
Pawnee (near)	3			7:30 a	8.7+	C. C. Talbert, 4 miles south and 6 miles east of Pawnee, reported that a No. 2 tub (rainfall equivalent of 8.7 inches) ran over at 7:30 a. m. on Sept. 4, 1940. U. S. E. D.
	4					
Ralston	2	2:30 p.	4:30 p.	Early a. m	0	Weather Bureau observer. 8-inch standard nonrecorder. Arkansas River at Ralston up to gage height of 9 feet at peak; river rose about 4.5 feet.
	3	9:00 a.		Early a. m	.16	
	4		2:00 p.	Early a. m	4.60	
	5			Early a. m	3.54	
Ralston (near)	3	A. m.		End of storm	8.00	F. Pipe Stem, 4 miles south of Ralston on farm, caught 8 inches in a straight-sided can. Reliable. Great deal of run-off in this area. All small creeks flooded. Not much crop damage, however, as land has considerable slope in this locality.
	4		Early p. m.			
Payne County:						
Yale	3			do	7.70	W. E. Christman in Yale, measured rainfall in a No. 2 tub. Tub was filled to within 1 inch of top; rainfall calculated as 7.7 inches.
	4					
Yale (near)	3			do	16.50	J. L. Ellis, 2½ miles east and 1 mile north of Yale, measured 16.5 inches in an oil barrel. U. S. E. D.
	4					
Tulsa County:						
Bixby (near)	3			do	11.00	R. E. Burnby, ½ mile south of Bixby, measured 11 inches in a straight-sided can. U. S. E. D.
	4					
Do	3			do	14.00	Ray O'Hern, 5 miles south of Bixby, measured 14 inches in a stock tank. U. S. E. D.
	4					
Do	3			(?)	14.50+	Tom Madison Grocery, 4 miles south and 7 miles west of Bixby, measured 14.5 inches and Mr. Madison said possibly an inch ran over. U. S. E. D.
	4					
Do	3			End of storm	9.50	Snake Creek Store, 4 miles south of Bixby, measured 9½ inches in a straight-sided tub. U. S. E. D.
	4					
Do	3			do	13.00	Brown's Grocery Store, 7 miles south and 2 miles west of Bixby, measured 13 inches in an oil drum. Snake, Duck & Euchee Creeks did a lot of damage at this point. U. S. E. D.
	4					
Broken Arrow (SCS No. 1)	3			5:00 p	0	C. C. C. camp, SCS-Ok-22, located at Broken Arrow. 8 inch standard non-recorder. No flash or heavy rains.
	4	12:01 a.	3:30 p.	5:00 p	4.51	
	5	8:15 a.	9:30 a.	5:00 p	.29	
Broken Arrow (near)	3			End of storm	7.00	Mr. E. C. Carter, 5 miles west of Broken Arrow, measured 7 inches in a gallon bucket. U. S. E. D.
	4					
Collinsville	3	DNA		do	2.00	Santa Fe ticket agent at Collinsville estimated 2 inches for storm and reported this amount to the railroad company. A slow steady rain.
	4		P. m.			
Jenks (near)	3			do	17.00	W. F. Young, 2 miles west and 1¼ miles south of Jenks, had bucket which measured 0.85 foot deep, 0.93 foot across top and 0.76 foot at bottom. Bucket caught full twice. Rainfall equivalent for 2 buckets full is 17 inches.
	4					
Oneta (near), (SCS No. 2)	3			6:00 p	.20	C. C. C. camp, SCS-Ok-22, Broken Arrow, Oklahoma. Gage located 5 miles southwest of Oneta. 8 inch standard nonrecorder.
	4	2:00 a.	4:00 p.	6:00 p	6.10	
	5			6:00 p	.28	
Skiatook	3	A. m.		End of storm	5.00	C. F. Rodgers, Skiatook, Oklahoma, measured 5 inches in a 50-gallon drum well exposed. He measured all rainfall. Good record. Bird Creek about ½ bank-full at Skiatook.
	4		A. m.			
Tulsa (city)	3	3:15 p.		Early a. m	.08	Weather Bureau observer. 8 inch standard nonrecorder.
	4		10:30 a.	Early a. m	3.38	
	5			Early a. m	4.11	
	6			Early a. m	.65	

TABLE 2.—*Hourly rainfall amounts (inches) at Tulsa Airport, September 3–4, 1940*

Hour	Third a. m.	Third p. m.	Fourth a. m.	Fourth p. m.
1	0	0	0.11	0.22
2	0	0	.22	.15
3	0	0	.34	.02
4	0	0	.30	.01
5	0	.01	.26	.01
6	0	.05	.17	.02
7	0	0	.15	0
8	.03	0	.19	0
9	0	0	.24	0
10	0	0	.21	0
11	0	0	1.61	0
12	0	.06	1.98	0

FLOOD-STAGE REPORT FOR SEPTEMBER 1940

[All dates in September unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
	Feet			*Feet*	
James: Columbia, Va	10	Aug. 31	3	16.0	1
Saluda: Pelzer, S. C	6	1	1	6.9	1
Catawba: Catawba, N. C	8	Aug. 30	2	16.0	Aug. 31
Santee:					
Rimini, S. C	12	1	3	13.4	3
Ferguson, S. C	12	(1)	3		
Savannah: Butler Creek, Ga	21	1	2	22.9	1
MISSISSIPPI SYSTEM					
Arkansas Basin					
North Canadian: Yukon, Okla	8	5	5	9.1	5
Arkansas: Tulsa, Okla	16	4	5	19.3	5

[1] Continued from preceding month.

ESTIMATED FLOOD LOSSES AND SAVINGS DURING 1938

By BENNETT SWENSON

[U. S. Weather Bureau, Washington, Oct. 1940]

The estimated flood losses during the year 1938 (table 1) total $101,099,645. The average annual loss for the years 1924 to 1938, inclusive, is approximately $105,000,000. The greatest annual loss during this period occurred in 1937 with a total estimated loss of approximately $482,000,000, and the least in 1931 with a total of about $2,800,000.

The outstanding floods during the year, with estimated losses, were as follows:

Floods in New England during September caused damage amounting to about $37,000,000; early in March a total loss of approximately $24,500,000 occurred during the severe floods in southern California; and in July a loss of more than $5,000,000 was reported from floods in the Colorado River in Texas.

The reported savings as the result of flood warnings during the year, shown in table 2, reach a total of more than $11,000,000.

TABLE 1.—*Estimated flood losses during 1938*

River and drainage	Tangible property totally or partially destroyed	Matured crops	Prospective crops	Livestock and other movable farm property	Suspension of business	Total
ST. LAWRENCE						
Maumee River			$2,600			$2,600
Rivers in southeastern Michigan						119,350
Saginaw River	$9,350		11,900	$550	$1,000	22,800
Grand River	90,100			700	4,400	95,200
ATLANTIC SLOPE						
Merrimack River						[1] 6,000,000
Connecticut River	23,673,000		[2] 1,923,000			[1] 25,596,000
Mohawk River						100,000
Hudson River						5,220,000
Susquehanna River	130,900	$10,210	3,090	1,000	7,025	152,225
Roanoke River	5,000	11,000	281,000		46,000	343,000
Neuse River	3,800	1,000	35,200	600	3,500	44,100
Cape Fear River			2,750	250	1,000	4,000
Tar River			28,500		2,000	30,500
Savannah River				650	4,750	5,400
Altamaha River	7,000	200	8,000	3,600	9,000	27,800
EAST GULF OF MEXICO						
Apalachicola River	4,100		3,300	3,650	10,250	21,300
Pea River	37,500					37,500
Choctawhatchee River	47		3,000			3,047
Conecuh River	23,300	220	12,600		1,900	38,020
Alabama River	375,000	12,700	276,000	17,600	221,000	902,300
Black Warrior and Tombigbee Rivers	40,400	500	2,450	4,060	45,000	92,410
Pascagoula River	145,000	3,700	86,000	9,000	25,000	268,700
Pearl River	95,000	2,300	165,000	5,300	24,000	291,600
UPPER MISSISSIPPI BASIN						
Chippewa River	72,000	5,000	20,000	15,000		112,000
Whitewater and Zumbro Rivers	80,000	40,000		2,000		122,000
Black River (Wis.)	52,000	15,000				67,000
Root River (Minn.)	10,000	10,000				20,000
Wisconsin River	204,315	524,150	155,600	13,535	42,100	939,700
Turkey River	26,200					26,200
Rock River	440,000	245,000	35,000	31,000	45,000	796,000
Cedar-Iowa Rivers	1,000	1,500			1,000	3,500
Des Moines River	9,750	58,750	3,800	250	300	72,850
Illinois River	15,200					15,200
Mississippi River above Cairo, Ill	1,164,250	125,800	148,300	2,940	43,560	1,484,850
MISSOURI BASIN						
Rivers in Montana						1,039,000
Rivers in Colorado	679,000					679,000
Fall River in South Dakota	25,000					25,000
Big Sioux River	25,000		86,000	5,000		116,000
Smoky Hill River	425,000		440,000	18,000	11,000	894,000
Republican River	7,000		6,000			13,000
Osage River	15,000	100,000	181,000	2,200	7,000	305,200
Missouri River	165,785	137,500	942,000	12,100	4,550	1,261,935
OHIO BASIN						
Muskingum River		5,500	13,000		5,000	23,500
Scioto River			3,200			3,200
Green River			10,000			10,000
Wabash River	171,130	275,200	3,596,750	6,200	188,100	4,237,380
North Fork of Holston River	15,000		700			15,700
Wautauga River (Brush Creek)	100,000	5,000			1,000	106,000
Little Pigeon and Little Rivers	62,000		8,000	15,000		85,000
WHITE BASIN						
Black River	17,000		500	200	6,000	23,700
White River	99,000	8,700	25,800	9,200	24,900	167,600
ARKANSAS BASIN						
Little Arkansas River	2,000	5,000	500		2,000	9,500
Walnut River			210,000			210,000
Ninnescah River	26,200		29,600	300		56,100
Verdigris River	5,000		105,000			110,000
Cottonwood River	4,450	6,000	180,000	3,200	10,000	203,650
Neosho River	94,350	120,346	455,500	25,500	57,460	753,156
North Canadian River	80,100	500	10,050		100	90,750
South Canadian River						50,000

[1] Furnished by U. S. Engineer Office.
[2] Including all agricultural losses.